THE PALADIN ENTERPRISE MODEL OF RECAPITALIZATION

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Introduction

Every so often, a "good news" story comes along that must be shared with others. The Paladin Production Enterprise, a highly successful government-industry partnering effort resulting in the production of 786 M109A6 Paladin 155mm Self-Propelled Howitzers is just such a story. Simply called the "Paladin Enterprise," this pioneering effort was conducted from 1993-1999 at Letterkenny Army Depot (LEAD) in Chambersburg, PA. The principal participants included LEAD; United Defense Limited Partnership (UDLP); the Product Manager (PM), Paladin/Field Artillery Ammunition Support Vehicle (FAASV); and the Defense Logistics Agency (DLA).

Recipient of the prestigious DOD Standardization Award, the Paladin Enterprise deserves special recognition because it resulted in every howitzer being delivered ahead of schedule, within budget, and with no major material or quality deficiencies. Another key achievement is that during the 6-year production run, numerous improvements were introduced and universally applied so that each and every vehicle was configured precisely like every other.

It is important to add that the Paladin and its companion armored ammunition carrier, the FAASV, introduced a "revolution in cannon artillery" by enabling a huge increase in responsiveness, survivability, and lethality over its older cousins that were used during the period from Vietnam through the Gulf War. Although the term was not yet in vogue, we might now call the Paladin Program a recapitalization program with upgrades. Therefore, it is instructive to review the decisions made and actions taken early in the program so they can be applied as lessons to current recapitalization efforts.

M109 History

The original M109 Howitzer was introduced to the Army during the early 1960s. Before Paladin, the M109 Howitzers received a series of upgrades focused primarily on improving reliability. In 1985, the Army initiated the most extensive modernization effort to date resulting in the modern-day M109A6 Paladin. Like other legacy systems, the Paladin (at 32 tons) is too large and too heavy for transport by C-130 aircraft. Over one-half of the Paladins belonging to the Army's Active components will eventually be displaced to the Army National Guard as a result of fielding the Crusader between 2008 and 2012. A significant number of Paladins will then remain side by side with Crusader in the Active force until they are replaced by the Future Combat Systems. Thus, a second technology infusion recapitalization may prove extremely beneficial during this transformation of the artillery force.

In the 1980s, four main deficiencies in the existing M109 fleet were identified: lethality, survivability, responsiveness, and overall system reliability. The fleet had aged to where it could no longer fully meet the current threat. The Howitzer Improvement Program—the precursor to the Paladin Program—was thus initiated to address those deficiencies. The Required Operational Capability, dated Aug. 2, 1988, required a range of at least 22 km unassisted, 30 km assisted, and an alternative cannon to be developed to achieve extended range beyond 40 km. It specified a cruising range of more than 180 miles, a combat-loaded weight under 32-1/2 tons, and a driver's night-vision device.

Improved survivability was to be provided by improved ballistic shielding; fire prevention protection; and nuclear, biological, and chemical protection. The revolution, however, would come from an onboard fire control computer capable of onboard ballistic computation and automatic gun laying, integrated with a highly accurate navigation system and digital communications. This freed the M109A6 from needing surveyed firing points and

Paladin test firing at Yuma Proving Ground, AZ. An extended-range Paladin was tested later, but not fielded.

close proximity to the Battery Computer System. This resulted in a quantum leap in responsiveness and revolutionary changes in doctrine and tactics—frequent survivability moves ("shoot and scoot"). Ultimately, it allows fighting in highly dispersed platoons rather than in tightly controlled batteries.

Further upgrades were envisioned in a Preplanned Product Improvement (P3I) Program. Many of the improvements, including mobility, rate of fire, range, and survivability, were developed and tested to varying degrees both before and during production. Although these P3I items were eventually rejected, they could still be adopted as product improvements.

Recapitalization And The Paladin Enterprise

The Army decided the most economical course of modernization would be to rebuild and upgrade the existing M109 chassis with new, more powerful engines, stronger suspensions, and upgraded transmissions; then add an all-new cab structure with improved main armament and a revolutionary fire control system. In the end, up to $400,000 was saved per vehicle compared to a totally new build. The resulting Paladin is nevertheless reliable and affordable to maintain, and the improved chassis has just begun to qualify for overhauls—amazingly at the same rate predicted for an all-new vehicle. This clearly validates the Enterprise approach.

After the low-rate initial production of 164 vehicles by BMY Combat Systems, York, PA, the Army chose to compete the full production program of 786 Paladins. To nearly everyone's surprise, the competition was won by FMC, a decided underdog. The key to their winning bid was their unique proposal to create an "Enterprise" approach collocated with the government's chassis operation at LEAD. Both cost and program risks were reduced by using government facilities and workers teamed with a collocated FMC workforce. The Defense sectors of FMC and BMY soon merged, creating UDLP. The new company used and improved on the innovative processes proposed by FMC and embraced the government members of the team, thus capitalizing on the best that public and private sectors had to offer. Many members of the Army Acquisition Corps had the privilege to visit the Paladin Production Enterprise while attending various Defense Acquisition University courses, most notably the Advanced Program Management Course. All who visited were amazed by the cooperative "can-do" spirit and the sheer absence of any "we-they" attitude. The Paladin Enterprise was truly a team effort.

New larger cab being joined to completely refurbished chassis at Letterkenny Army Depot.

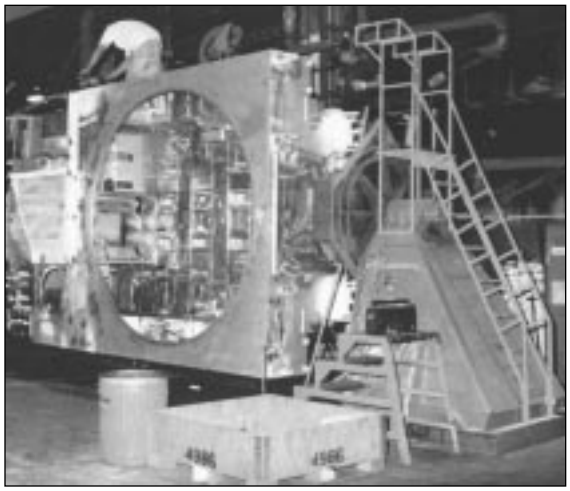
Technology Infusion

The Paladin production process began with the induction of an earlier version M109 by LEAD personnel, and the subsequent "tear-down" of the turret, power pack, track, suspension, and every other bolt-on item. All brackets, panels, and parts considered unnecessary were sawed or chiseled off. The hull was sandblasted to bare metal in preparation for modifications. The hull was also modified through a series of welding and machining processes with enhancements such as selective strengthening, larger torsion bars, hydraulic bump stops, and a new remote-controlled travel lock.

Every joint, new and old, was thoroughly X-rayed, inspected, and rewelded as necessary. This "like-new" hull structure was then reassembled using new, more powerful engines, improved transmissions, a new suspension and track, and a 650-amp generator replacing the older 100- to 180-amp power sources. The result was a "zero-hours, zero-miles" chassis with far

more speed, power, strength, and mobility than all prior M109 Howitzers.

The completed chassis was provided to UDLP, which integrated an all-new larger cab that had been produced at their York, PA, facility. However, all assembly and integration work was completed in their building on LEAD property. Letterkenny and UDLP personnel jointly performed road, firing, and navigation tests on the assembled howitzer before government acceptance and final painting. At full-rate production, 16 to 18 vehicles were rolling off the line per month—all early for more than 2 years, all within budget, and all without deficiencies.



Completely stripped chassis being sanded, welded, and modified to achieve "as-new" condition.

The Enterprise Spirit

Contrary to conventional wisdom that government-furnished equipment (GFE) can't be counted on, both LEAD and UDLP were provided a great deal of GFE by PM, Paladin/FAASV—on time, according to agreed-upon schedules. Conversely, LEAD provided many parts and assemblies to UDLP, and UDLP provided many parts and assemblies to LEAD. The real spirit of the Enterprise was the fact that every member was both a customer and a supplier to every other member, so nobody could succeed or fail on their own. This teamwork did not happen by accident. A highly respected consultant was brought in at the outset to help forge a shared vision and set of values for the Enterprise. Subsequently, all members worked together to obtain waivers and exemptions to then-existing regulations to minimize both paperwork and surcharges associated with the flow of parts among the Army, DLA, and UDLP.

The Paladin Enterprise is a shining example of what the Army hopes to gain from current and future recapitalization programs, and what can happen when government and industry team with common goals and objectives. Vehicles were produced that were more reliable, maintainable, and combat capable. The improvements were so significant that they have changed the way artillery units fight, while decreasing their workload and support burden.

Lessons Learned

In retrospect, the following can be considered key to the success of the Paladin Enterprise's Recapitalization Program:

- Jointly develop user and PM requirements to find the most cost-effective performance increases.
- Establish common goals and objectives for the team.
- Identify and understand the needs of all stakeholders.
- Don't be afraid to go to "outsiders" for expertise.
- Build and maintain positive relationships. Trust is key.
- Empower teams and set clear expectations of them. They must know that they have both responsibility and the requisite authority.
- Question authority. You *can* get relief from rules and regulations that don't make sense for your program.

If the above lessons are applied to a government-industry partnership so that walls between organizations fall, then teams can work "out-of-the-box" for a common goal. This allows legacy system recapitalization projects to remain relatively inexpensive, while still providing immediate benefits to soldiers in the field. Soldiers can then quickly be provided with the best possible weaponry and materiel to fight today and tomorrow.

Postscript: PM, Paladin/FAASV and UDLP are proud of their shared achievements and are now working with new partners at Anniston Army Depot, Anniston, AL; and the Defense Depot, Anniston AL; in recreating the spirit of partnership and joint ownership at a new location. This new Enterprise is now producing additional Paladins for the Army National Guard, whose divisions sorely need the mobility, survivability, effectiveness, and digital interoperability that only Paladin can provide.

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